

Attorney Docket No. 09792909-4817

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:

H. Tsujimoto et al.

Application No. 09/822,926

Filed: March 30, 2001

For: MATERIAL FOR POSITIVE
ELECTRODE AND SECONDARY
BATTERY

Group Art Unit: 1746

Examiner: Jonathan Crepeau

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December 3, 2004.

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450IN THE CLAIMS

1. (Currently Amended) A non-aqueous electrolyte secondary battery comprising a positive electrode, a negative electrode and a non-aqueous electrolyte, wherein the positive electrode contains:
- (a) a manganese-contained complex oxide containing:
- (i) lithium (Li);
- (ii) manganese (Mn);
- (iii) a first element (Ma) selected from the group consisting of zinc (Zn), cobalt (Co), aluminum (Al), tin (Sn), chromium (Cr), and magnesium (Mg), wherein the chemical formula of the manganese-contained complex oxide is $\text{Li}_x\text{Mn}_{2-y}\text{Ma}_y\text{O}_4$ and wherein x is the range of $0.9 \leq x \leq 2.0$ and y is in the range of $0.01 \leq y \leq 0.50$, both inclusive; and
- (b) a nickel-contained complex oxide containing:
- (i) lithium (Li);

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(ii) nickel (Ni);

(iii) a second element selected from the group consisting of iron (Fe), zinc (Zn), cobalt (Co), aluminum (Al), tin (Sn), chromium (Cr), and magnesium (Mg), wherein the chemical formula of the nickel-contained complex oxide is $\text{LiNi}_{1-z}\text{Ma}_z\text{O}_2$ and wherein z is the range of $0.01 \leq z \leq 0.05$ 0.50, both inclusive; and

~~(c) wherein cobalt (Co) is contained in not more than one of the manganese combined complex oxide and the nickel contained complex oxide.~~

2. (Original) The non-aqueous electrolyte secondary battery of claim 1, wherein a mixing ratio of the nickel-contained complex oxide to the manganese-contained complex oxide in the positive electrode, in terms of mass ratio (nickel-contained complex oxide/manganese-contained complex oxide), lies within the range of 90/10 to 10/90.

Claims 3-6 (Cancelled)

7. (Original) The non-aqueous electrolyte secondary battery of claim 1, wherein at least either the positive electrode or the negative electrode includes a positive electrode mixture layer or a negative electrode mixture layer provided on both sides or one side of a positive electrode collector layer or a negative electrode collector layer.

8. (Original) The non-aqueous electrolyte secondary battery of claim 1, wherein the negative electrode contains a material capable of occluding and releasing lithium.

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9. (Original) The non-aqueous electrolyte secondary battery of claim 1, wherein the negative electrode contains at least one material selected from the group consisting of a metal and a semiconductor capable of forming an alloy and a compound with lithium, an alloy and a compound of the metal and the semiconductor, a carbon material, a metal oxide, and a polymer material.

10. (Original) The non-aqueous electrolyte secondary battery of claim 9, wherein the negative electrode contains at least one material selected from the group consisting of non-graphitizing carbon, artificial graphite, coke, graphite, glasslike carbon, polymer organic compound calcined materials, carbon fiber, activated carbon and carbon black.

11. (Original) The non-aqueous electrolyte secondary battery of claim 9, wherein the negative electrode contains at least one material selected from the group consisting of a Group 4B metal element, a semiconductor element, and an alloy and a compound of the metal element and the semiconductor element.

12. (Original) The non-aqueous electrolyte secondary battery of claim 9, wherein the negative electrode contains at least one material selected from the group consisting of silicon (Si), tin (Sn), and an alloy and a compound of silicon and tin.

13. (Original) The non-aqueous electrolyte secondary battery of claim 1, wherein: the positive electrode and the negative electrode includes a positive electrode mixture

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layer or a negative electrode mixture layer provided on both sides of either a positive electrode collector or a negative electrode collector made of a band-shaped metal foil; and

wherein the positive electrode and the negative electrode are stacked with a microporous separator interposed therebetween and are rolled spirally.

14. (Original) The non-aqueous electrolyte secondary battery of claim 1, wherein the electrolyte contains lithium salt and solvent; wherein:

the solvent contains at least one material selected from the group consisting of propylene carbonate, ethylene carbonate, diethyl carbonate, dimethyl carbonate, 1,2-dimethoxyethane, 1,2-diethoxyethane, γ -butyrolactone, tetrahydrofuran, 2-methyl tetrahydrofuran, 1,3-dioxolane, 4-methyl-1,3-dioxolane, diethyl ether, sulfolane, methyl sulfolane, acetonitrile, propionitrile, anisole, ester acetate, ester butyrate and ester propionate.

15. (Original) The non-aqueous electrolyte secondary battery of claim 1, wherein the electrolyte contains at least one electrolyte selected from the group consisting of a gel electrolyte in which an electrolyte solution containing lithium salt is held in a polymer compound, a solid electrolyte in which lithium salt is dispersed onto a polymer compound having an ion conductivity, and an electrolyte made of solid inorganic conductor.

16. (Currently Amended) A material for a positive electrode containing:

(a) a manganese-contained complex oxide containing:

(i) lithium (Li);

(ii) manganese (Mn);

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(iii) a first element selected (Ma) from the group consisting of zinc (Zn), cobalt (Co), aluminum (Al), tin (Sn), chromium (Cr), and magnesium (Mg), wherein the chemical formula of the manganese-contained complex oxide is $\text{Li}_x\text{Mn}_{2-y}\text{Ma}_y\text{O}_4$ and wherein x is the range of $0.9 \leq x \leq 2.0$ and y is in the range of $0.01 \leq y \leq 0.50$, both inclusive; and

(b) a nickel-contained complex oxide containing:

(i) lithium (Li);

(ii) nickel (Ni);

(iii) a second element selected from the group consisting of iron (Fe), zinc (Zn), cobalt (Co), aluminum (Al), tin (Sn), chromium (Cr), and magnesium (Mg), wherein the chemical formula of the nickel-contained complex oxide is $\text{LiNi}_{1-z}\text{Ma}_z\text{O}_2$ and wherein z is the range of $0.01 \leq z \leq 0.50$, both inclusive;

~~(e) wherein cobalt (Co) is contained in not more than one of the manganese combined complex oxide and the nickel-contained complex oxide; and~~

(dc) wherein a mean particle size of the manganese-contained complex oxide and the nickel-contained complex oxide is 30 microns or less.

Claims 17-19 (Canceled).

20. (Previously Presented) The non-aqueous electrolyte secondary battery of claim 16, wherein a mixing ratio of the nickel-contained complex oxide to the manganese-contained complex oxide in the positive electrode, in terms of mass ratio (nickel-contained complex oxide/manganese-contained complex oxide), lies within the range of 90/10 to 10/90.

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21. (Previously Presented) The non-aqueous electrolyte secondary battery of claim 16, wherein at least either the positive electrode or the negative electrode includes a positive electrode mixture layer or a negative electrode mixture layer provided on both sides or one side of a positive electrode collector layer or a negative electrode collector layer.

22. (Previously Presented) The non-aqueous electrolyte secondary battery of claim 16, wherein the negative electrode contains a material capable of occluding and releasing lithium.

23. (Previously Presented) The non-aqueous electrolyte secondary battery of claim 16, wherein the negative electrode contains at least one material selected from the group consisting of a metal and a semiconductor capable of forming an alloy and a compound with lithium, an alloy and a compound of the metal and the semiconductor, a carbon material, a metal oxide, and a polymer material.

24. (Previously Presented) The non-aqueous electrolyte secondary battery of claim 23, wherein the negative electrode contains at least one material selected from the group consisting of non-graphitizing carbon, artificial graphite, coke, graphite, glasslike carbon, polymer organic compound calcined materials, carbon fiber, activated carbon and carbon black.

25. (Previously Presented) The non-aqueous electrolyte secondary battery of claim 23, wherein the negative electrode contains at least one material selected from the group

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consisting of a Group 4B metal element, a semiconductor element, and an alloy and a compound of the metal element and the semiconductor element.

26. (Previously Presented) The non-aqueous electrolyte secondary battery of claim 23, wherein the negative electrode contains at least one material selected from the group consisting of silicon (Si), tin (Sn), and an alloy and a compound of silicon and tin.

27. (Previously Presented) The non-aqueous electrolyte secondary battery of claim 2, wherein: the positive electrode and the negative electrode includes a positive electrode mixture layer or a negative electrode mixture layer provided on both sides of either a positive electrode collector or a negative electrode collector made of a band-shaped metal foil; and wherein the positive electrode and the negative electrode are stacked with a microporous separator interposed therebetween and are rolled spirally.

28. (Previously Presented) The non-aqueous electrolyte secondary battery of claim 2, wherein the electrolyte contains lithium salt and solvent; wherein: the solvent contains at least one material selected from the group consisting of propylene carbonate, ethylene carbonate, diethyl carbonate, dimethyl carbonate, 1,2-dimethoxyethane, 1,2-diethoxyethane, γ -butyrolactone, tetrahydrofuran, 2-methyl tetrahydrofuran, 1,3-dioxolane, 4-methyl-1,3-dioxolane, diethyl ether, sulfolane, methyl sulfolane, acetonitrile, propionitrile, anisole, ester acetate, ester butyrate and ester propionate.

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29. (Previously Presented) The non-aqueous electrolyte secondary battery of claim 2, wherein the electrolyte contains at least one electrolyte selected from the group consisting of a gel electrolyte in which an electrolyte solution containing lithium salt is held in a polymer compound, a solid electrolyte in which lithium salt is dispersed onto a polymer compound having an ion conductivity, and an electrolyte made of solid inorganic conductor.